

The background of the lower half of the page is an aerial photograph of a city skyline at sunset. The sun is low on the horizon, casting a warm orange and red glow across the sky and reflecting on a river in the foreground. The city skyline, featuring several tall skyscrapers, is visible in the background. A dark blue semi-transparent box is overlaid on the lower left of the image, containing the title and date.

# Hurricane Harvey Registry Initial Report

February 2019

Share your Harvey experience at  
[HarveyRegistry.rice.edu](http://HarveyRegistry.rice.edu)



Share your Harvey experience at  
**HarveyRegistry.rice.edu**

**This report was prepared by the Children's Environmental Health Initiative (CEHI) at Rice University.**

**February, 2019.**

Calculations, including maps and summary statistics, were based exclusively on data available in the registry. Respondents who did not answer a question were excluded from any analysis involving that question.

All maps displayed in this report aggregate data to a sufficient scale to protect the confidentiality of the Hurricane Harvey Registry respondents.

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# Message from Project Leaders

**W**hen Hurricane Harvey hit, our community responded with courage, commitment, and compassion. As we realized the scope and scale of Harvey's impact, it became clear that we needed a systematic way to identify and track the long-term health and housing impacts of the storm. Out of this need, the Hurricane Harvey Registry was born.

Since launching in April 2018, the Hurricane Harvey Registry has been asking residents to share their Harvey experience. More than 13,000 individual registrants, capturing the living environments of over 39,000 residents, spanning 13 counties, have reflected on how Harvey impacted their physical health, mental health, property, financial security, and many other aspects of their life. In this document, we report on the 9,798 people who had registered by January 2, 2019. We are honored by the support this collaboration has received. With transparency and openness to the communities we serve, we are committed to moving the entire region forward through innovative public health solutions.

We want to especially thank each and every one of the registrants; your willingness to engage with us as citizen-scientists is part of what makes our community so special.

This initial report serves as an update on our journey thus far, but our work is far from over. We will continue to enroll community members in the registry so that we can better capture the range of experiences throughout the region. We are working hard to make sure that every single neighborhood, city, and county has a voice.

We ask that you help uplift the voices of your own community by spreading the word to your neighbors, friends, community groups, churches, and coworkers about the Hurricane Harvey Registry. Together, we can ensure that those same qualities of courage, commitment, and compassion shape our long-term recovery from Harvey.

Sincerely,

Mary Beth Bess, RN, MSN, FNP-BC, **Chambers County Health Department**

Elena Craft, PhD, **Environmental Defense Fund**

Mary DesVignes-Kendrick, MD, **Fort Bend County Health & Human Services**

Richard McBrayer, **Victoria Office of Emergency Management**

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Alicia Williams, MPH, CIC, **Montgomery County Public Health District**

Stephen L. Williams, MEd, MPA, **Houston Health Department**



# Project Summary

**I**n August 2017, Hurricane Harvey, one of the most destructive storms in our nation's history, made landfall.

Unprecedented rain from the storm dumped trillions of gallons of water on the region. Ten counties were declared disaster areas. More than 10,000 rescue missions were conducted, \$125 billion worth of damage was reported, and over 700,000 residents registered for Federal Emergency Management Agency assistance. These figures are moving, but do not capture the full range of experiences throughout Southeast Texas. From Houston to Bay City, from Fort Bend County to Galveston County, individuals and communities have been forever changed.

While some high-level statistics about Hurricane Harvey's impact are known, there remain significant gaps in understanding the full impact of Harvey on residents, especially regarding the storm's effects on health.

In Houston alone, over one quarter of homes were damaged or destroyed by floodwater.<sup>1</sup> Harvey's broader impact on housing in the region can also be examined by the extraordinary number of residents who were displaced from their homes—many, for months on end.

There are numerous chemical production and storage facilities including chemical plants, Superfund sites, and refineries in the greater Houston area, and the extent of air, soil, and water contamination has yet to be assessed. Receding flood waters likely resulted in widespread mold and bacterial contamination in residential and commercial structures.

How did exposure to environmental contaminants and psychological stressors impact the mental and physical health of individuals and communities in the region? What health and housing risks can government officials better address in preparation for fu-

ture storms? While many of these questions typically go unanswered in the aftermath of natural disasters, these questions continue to inspire our work.

With the initial idea for the registry born immediately after Harvey made landfall, the Hurricane Harvey Registry was officially launched in April 2018 with the objective of establishing a baseline understanding of the environmental health risks from the storm. Led by **Chambers County, the Environmental Defense Fund, Fort Bend County, Harris County Public Health, Houston Health Department, Montgomery County, Rice University's Children's Environmental Health Initiative, and Victoria County**, we continue to focus on documenting how the storm affected health in our communities, shaping public health solutions and better preparing the region for future weather disasters.

Since Harvey, many residents are working to recover. We work diligently to identify and connect residents to resources that will help support these recovery needs. **Ultimately, we recognize that this region has not fully recovered until we all have recovered.**

We are extremely excited to share this preliminary report with those who have registered, those who have not, and those looking for insight into Harvey's long-term impact. **We continue to recruit new registrants to engage the region as we work with partners to use information from the registry to build a more resilient community.**

**Please visit [HarveyRegistry.rice.edu](https://HarveyRegistry.rice.edu) to enroll in the registry and to learn more about insights the registry is providing.**

# Community Outreach

**T**he Hurricane Harvey Registry team is committed to building meaningful relationships, earning trust, and remaining visible in communities throughout the region.

In our efforts to build meaningful relationships, we engage public officials (city council members, neighborhood leaders, school districts, and other government leaders), local nonprofit organizations (BakerRipley, the Sierra Club, Interfaith Ministries, and others), churches, businesses, and a vast array of community stakeholders. These community-based relationships allow us to extend our reach and give us a better understanding of community needs.

The Hurricane Harvey Registry seeks to inspire and earn the trust of residents throughout the region. We are deeply committed to data privacy and security. At the same time, we work diligently to remain transparent with the public about our findings.

In addition to our ongoing community stakeholder recruitment efforts, we have a dedicated team committed to listening and responding to residents at a local level. We interact with community members at large scale events (from public health fair events to Houston Rockets games) and grassroots community meetings. We also lead canvassing and door-to-door outreach efforts to reach and inform residents.

**We welcome the opportunity to visit with your local community group, church, school, library, community center, or other gathering spot. To arrange such a visit, please email us at [HarveyRegistry@rice.edu](mailto:HarveyRegistry@rice.edu).**



# Hurricane Harvey Registrants

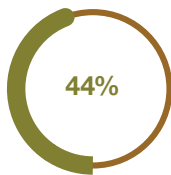
**9,798**  
**registrants**

as of Jan 2, 2019

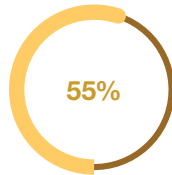
**Over 29,000 residents**  
**across the region captured**

On average, there are 3 people per household  
represented in the registry.

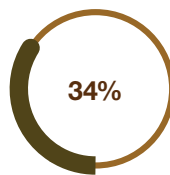
Home Flooded



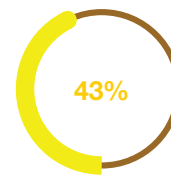
Home Damaged



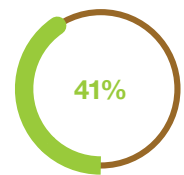
Vehicle Damage



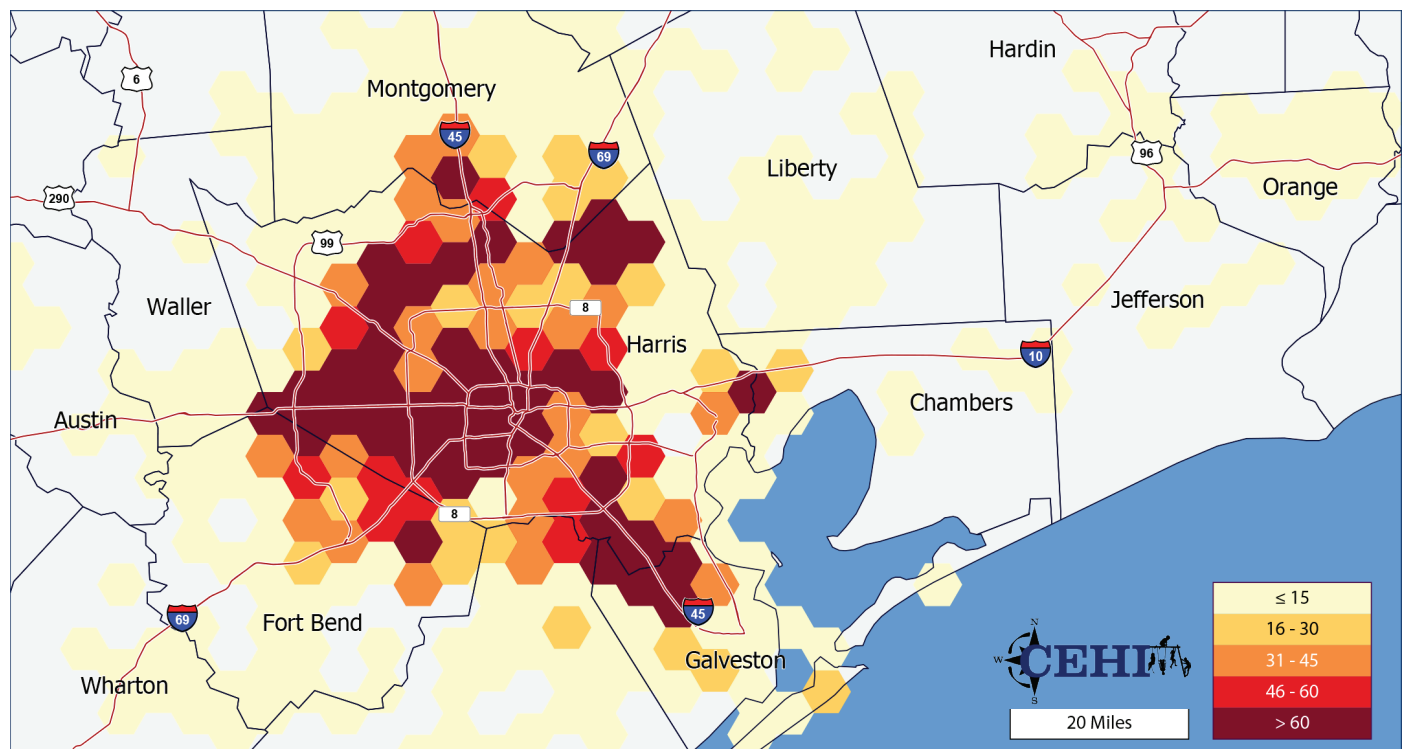
Electricity Loss



Income Loss



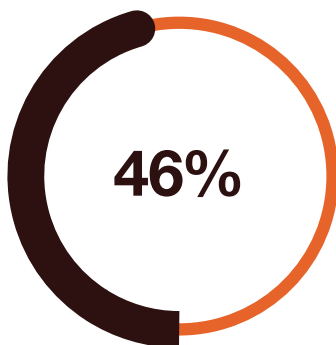
Number of respondents per 20 square mile hexagon



# Displacement

Research studies have linked housing displacement to poor mental health and have shown it is a barrier to long-term recovery.<sup>2,3</sup> Evidence-based interventions and policies can help reduce hurricane-related housing instability.<sup>4</sup>

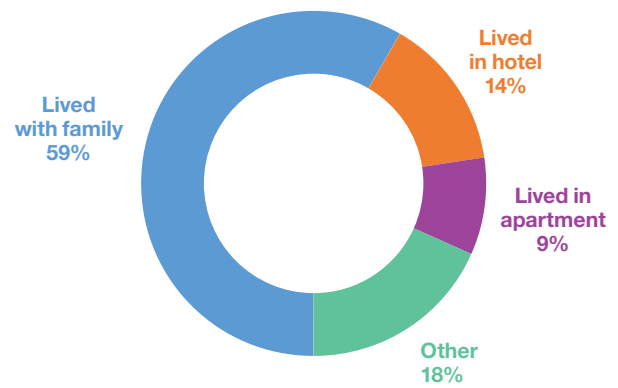
## Left Home



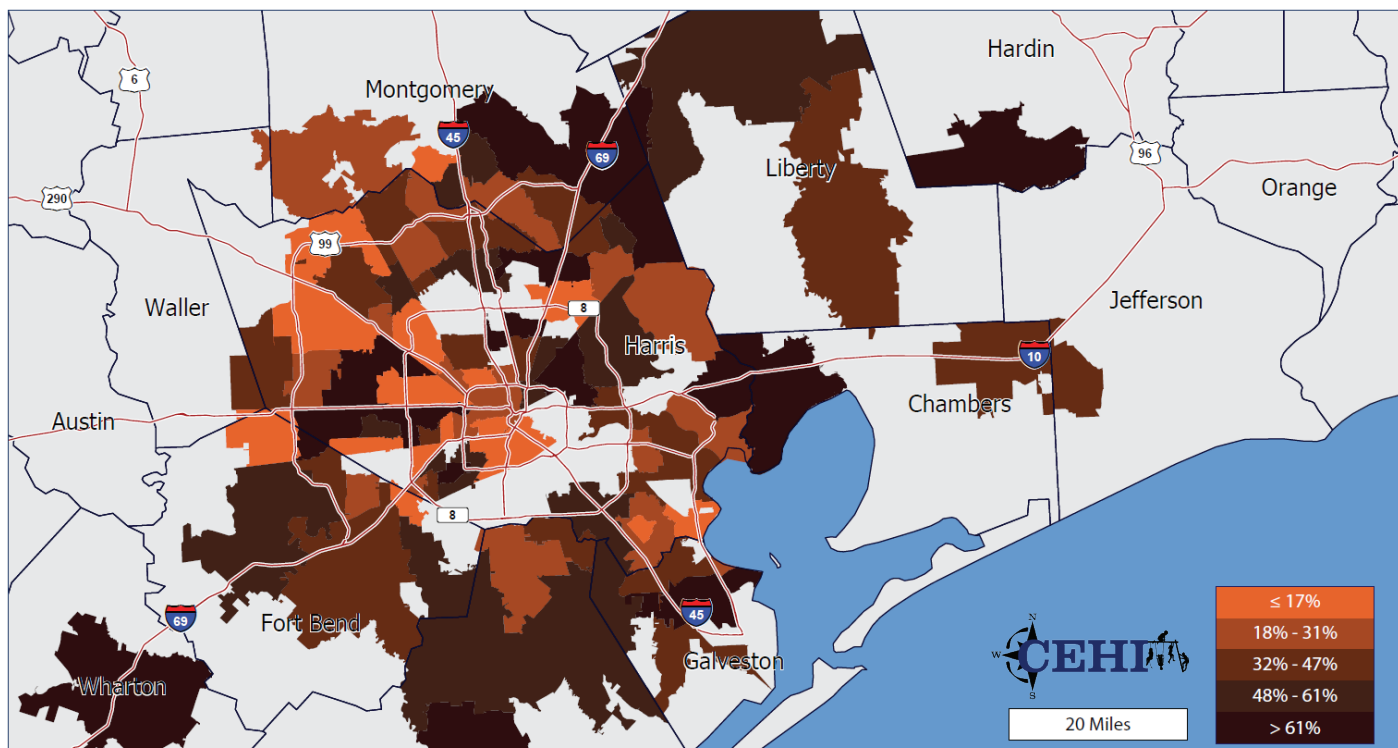
## 20 Weeks

Respondents who reported having to leave their home were displaced for an average of 20 weeks before moving back home.

## If you left your home, where did you go?



Percent of respondents who left home by Zip Code Tabulation Area

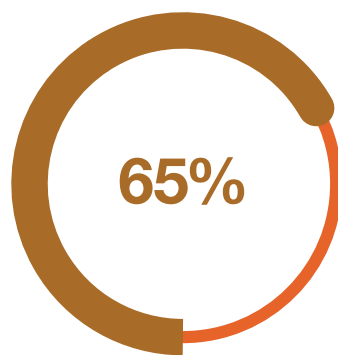




# Debris

Debris that comes in contact with flood waters are a public health threat due to chemical contaminants released by the flood. Older homes often contain higher levels of toxins, leaving residents more vulnerable to health effects caused by chemicals like lead, asbestos, and arsenic.<sup>5,6</sup>

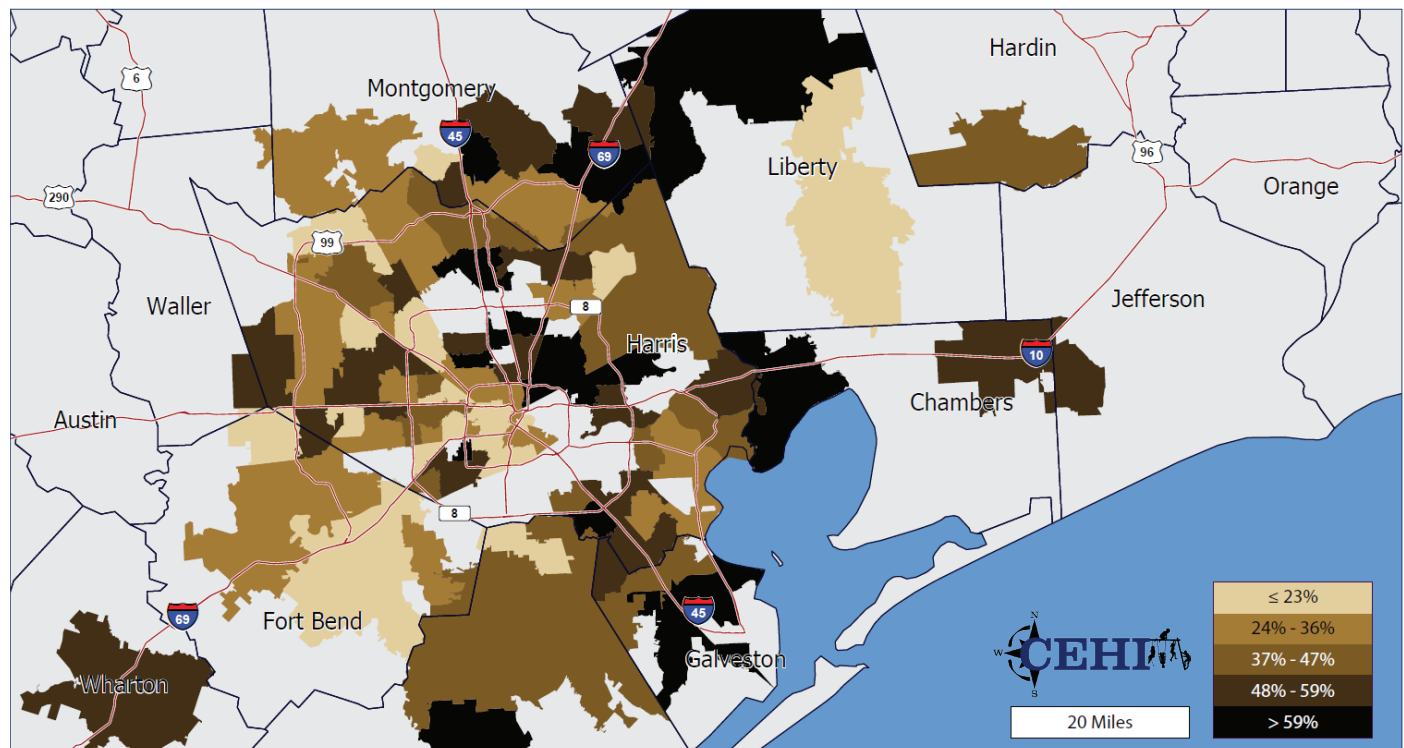
## Trash on Block



## 7 Weeks

On average, it took approximately seven weeks for piles of trash to be cleared.

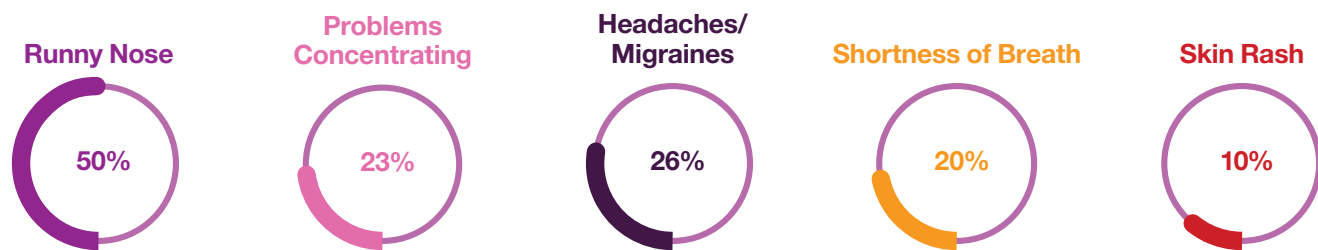
Percent of respondents with trash on their block in the aftermath of Harvey by Zip Code Tabulation Area



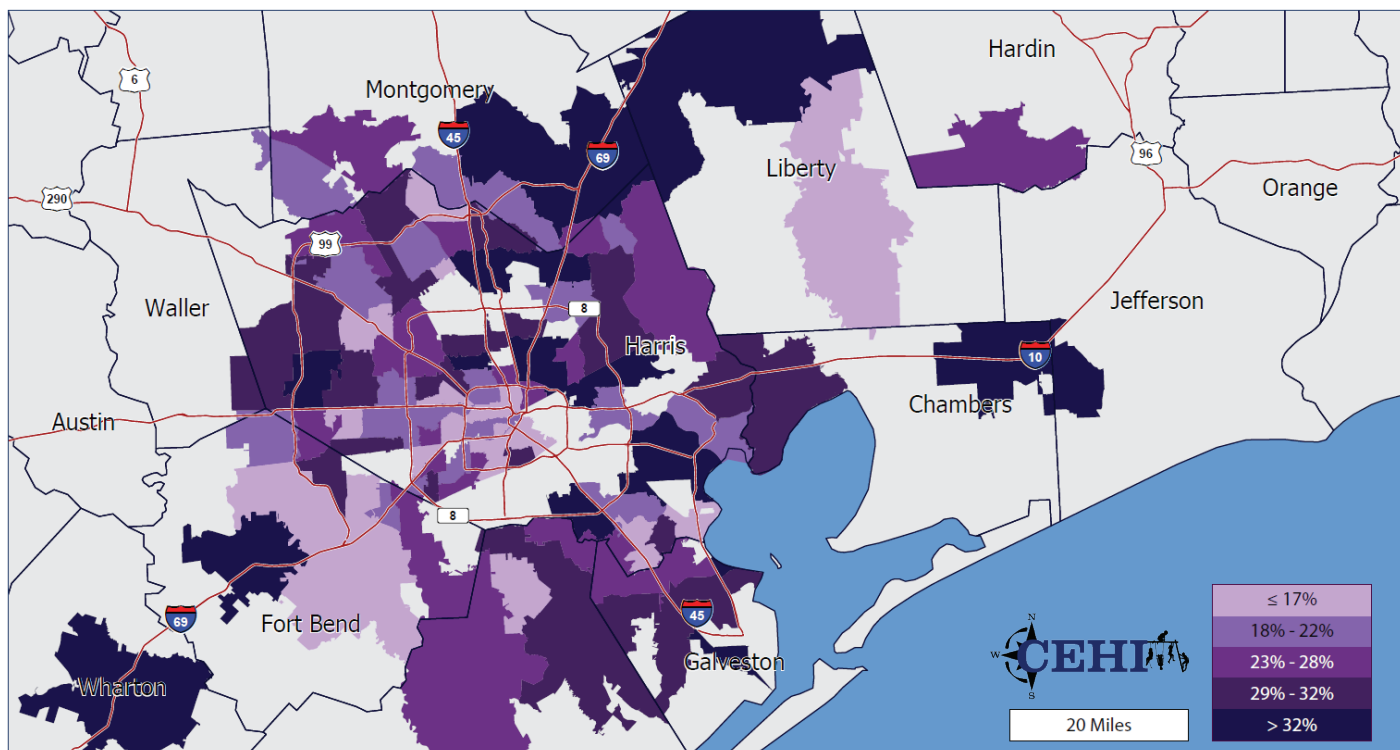
# Physical Health

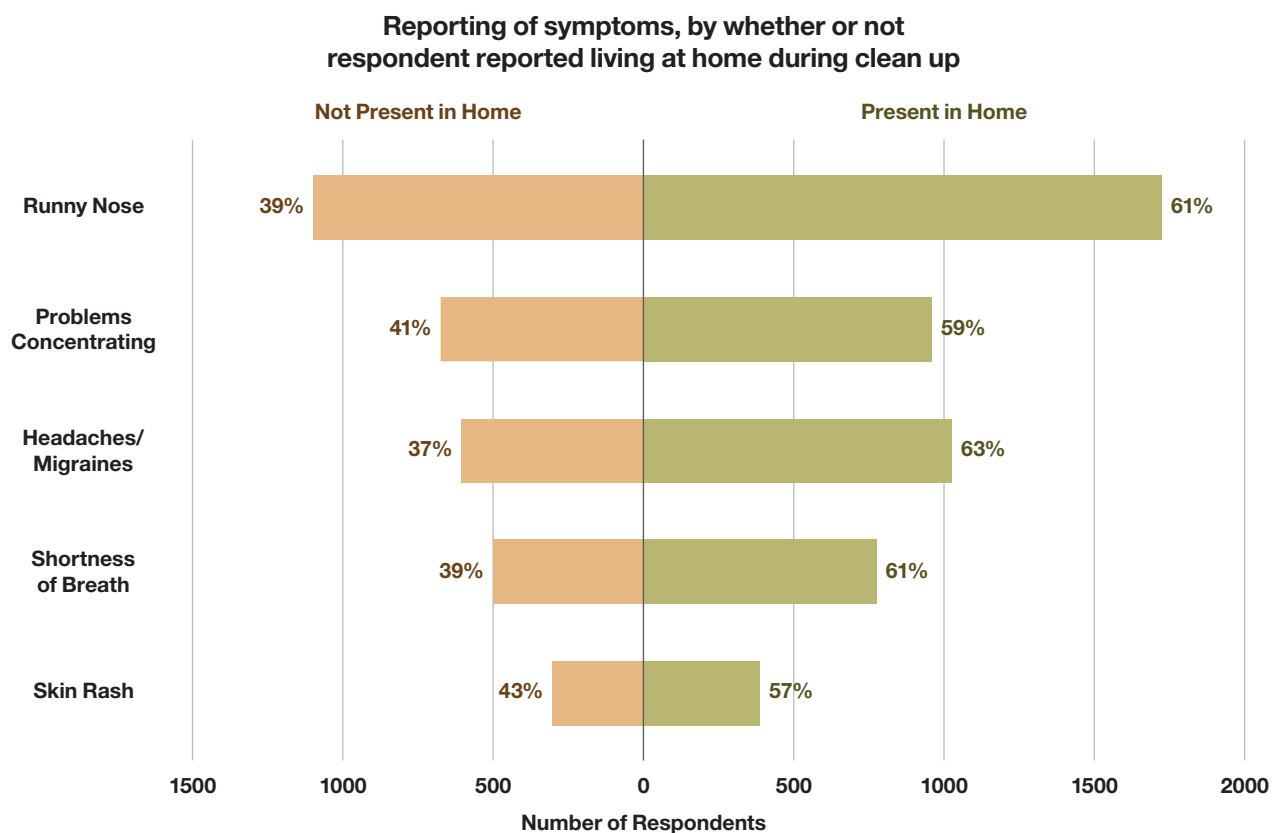
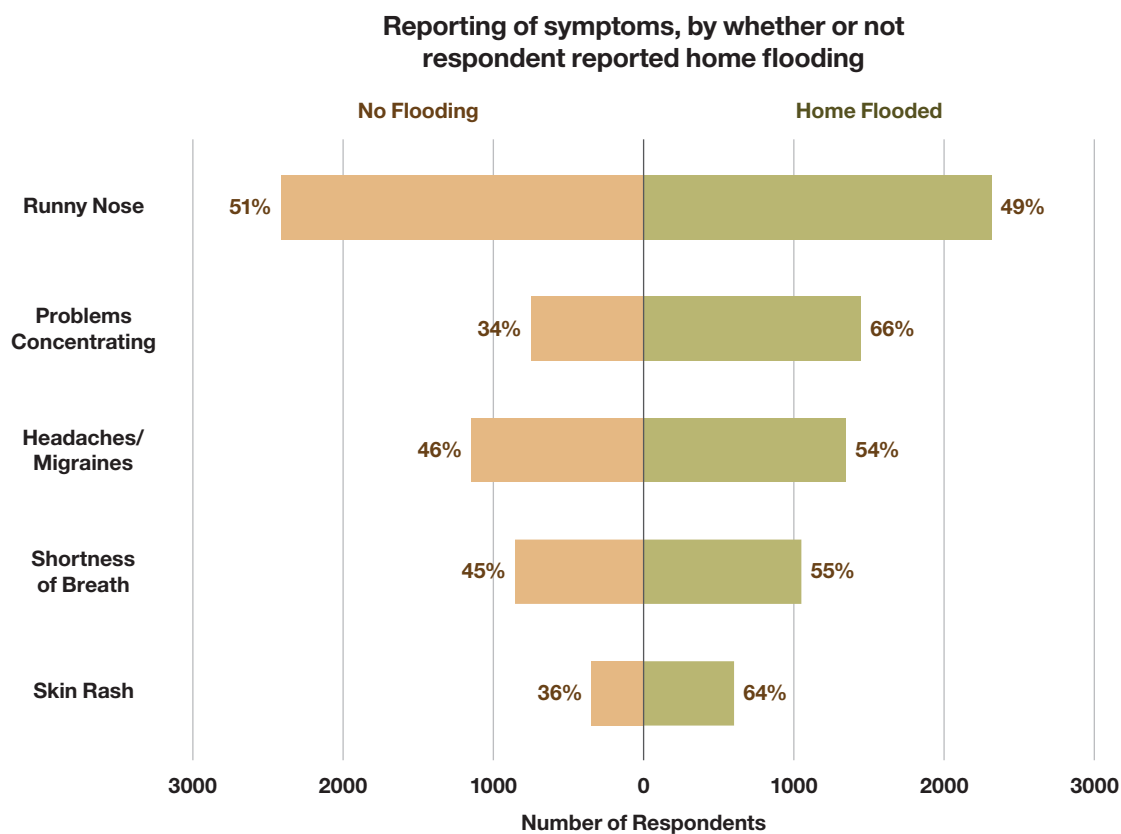
**R**esearch shows people who experience flooding or had contact with floodwaters are at risk for exposure to sewage, toxic chemicals, and other hazardous substances.<sup>7-9</sup>

Physical injuries commonly occur during clean-up where lack of knowledge or lack of proper cleaning materials and protective gear increase health risks, resulting from exposure to debris and harmful toxics.<sup>10</sup> Exposure to mold and bacteria during clean-up have been linked to new and worsening respiratory conditions including cough, difficult or labored breathing, sinus symptoms, asthma, and pneumonia.<sup>7</sup>



Percent of respondents who reported headache by Zip Code Tabulation Area

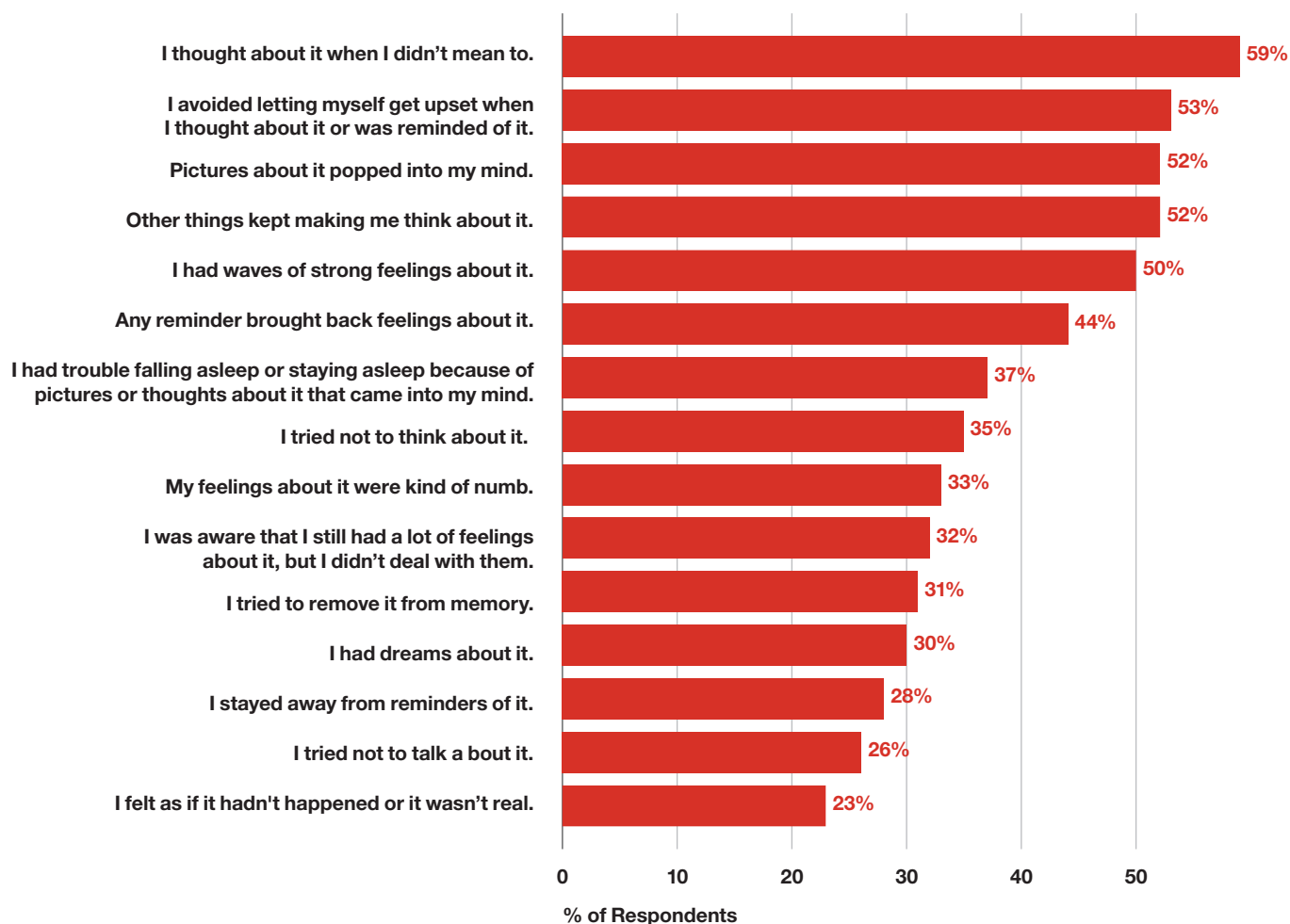




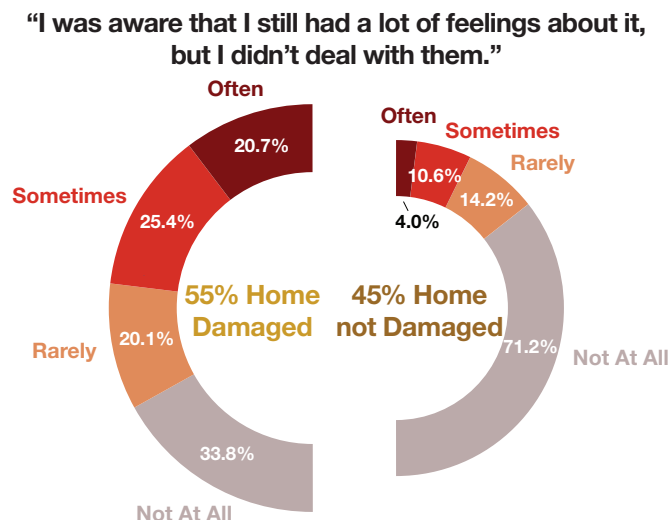
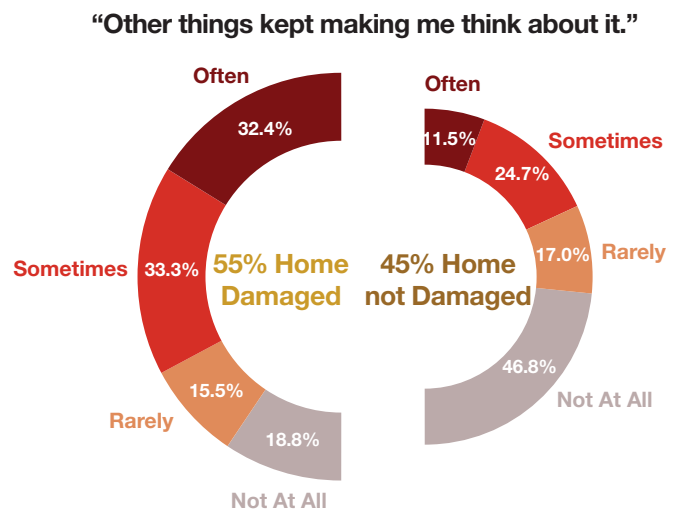
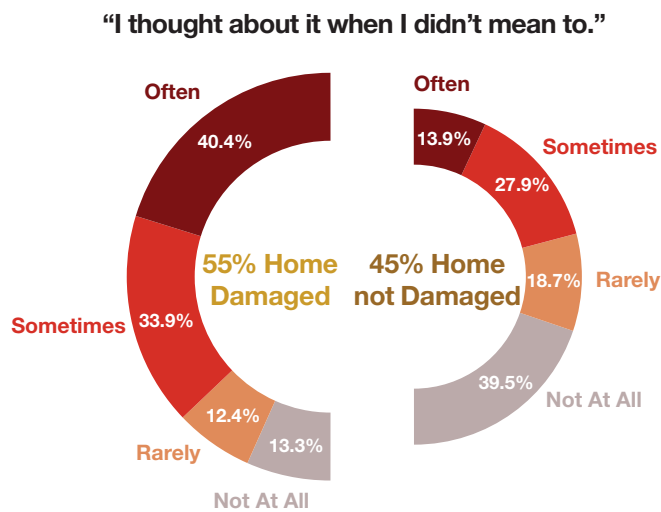
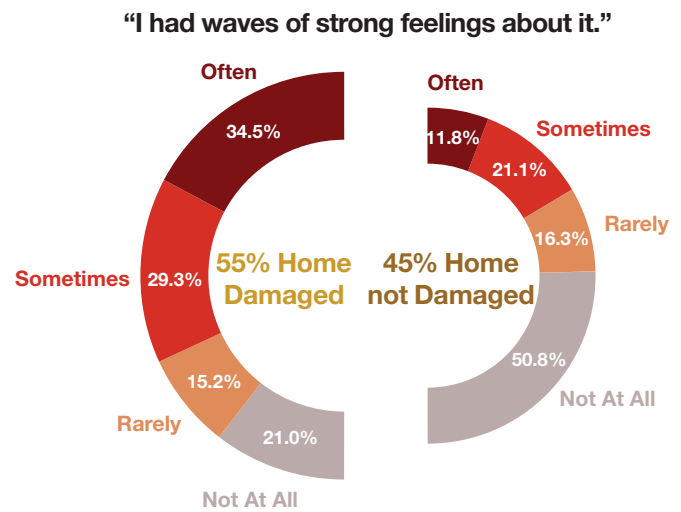
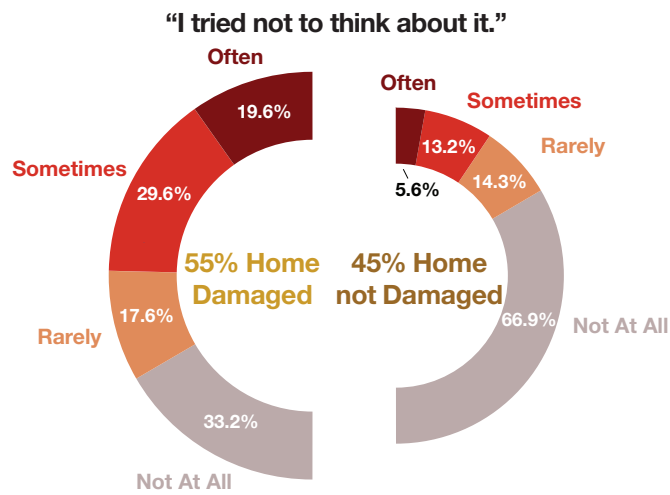
# Mental Health

Previous studies of hurricane survivors have shown that property loss and damage are associated with poor mental health. Sociodemographic factors including unemployment, hurricane-related physical illness and injury, and hurricane-related housing insecurity have also been linked to mental health problems.<sup>11</sup> Psychological reactions to natural disasters occur in waves of emotional highs and lows that take place well beyond the one-year anniversary of an event. Investigators have noted increases in mental conditions including post-traumatic stress disorder, several months or years after a hurricane occurs.<sup>12</sup> Identifying high risk populations and persistent stressors of people who lived through Harvey will help develop evidence-based prevention strategies for future disasters.<sup>13, 14</sup>

Percent of respondents reporting “sometimes” or “often”  
to having mental health difficulties







# Next Steps

**T**he Hurricane Harvey Registry team is committed to working actively to connect registrants with pertinent long-term recovery resources. The data we are collecting works to improve and design intervention programs and inform municipal governments about improvements needed in current recovery strategies.

Exposure to mold can result in allergies, respiratory symptoms, and other adverse health effects. Many families are still working to return to homes that were severely damaged. Some families continue to live in homes with mold or other harmful environmental contaminants. Hurricane Harvey collaborators are committed to addressing these areas of need through targeted intervention programs.

Asthma impacts over 1 million individuals in Texas alone.<sup>15</sup> It is extremely important that residents throughout the region have access to services that adequately address asthma triggers in their environment. Since Harvey, air quality has become an even greater concern. The Hurricane Harvey Registry will help the region better understand and identify gaps in air quality regulations currently in place. We will also be able to better support advocacy and intervention efforts aimed at addressing asthma within the state.

Mental health services remain a significant area of need for the entire region. Oftentimes, in the aftermath of traumatic stress, it can take months for mental health conditions to manifest. Many residents have reported anxiety, problems concentrating, persistent headaches, and other symptoms associated with the mental health impact of Hurricane Harvey. Factors like long-term displacement, financial challenges, and adverse health effects can all contribute

to anxiety, persistent headaches, and other mental health related symptoms. Mental health resource allocation and service delivery must be improved throughout the region. **The Hurricane Harvey Registry team is committed to laying the foundation for this improvement by highlighting Harvey's true impact on mental health throughout the region.**

Ultimately, understanding the needs of millions of residents across dozens of counties can be difficult. When natural disasters strike, resource allocation and long-term recovery across a region is of utmost concern. The Harvey Registry hopes to better inform and support ongoing recovery projects with vital input from residents. Whether it be mobile health clinic programs, mold remediation programs, or free food and vaccine programs, the Hurricane Harvey Registry is working to lay the foundation for a healthy, efficient, and equitable recovery.

We've come a long way but our work is far from over. We need your help to make sure that every community throughout the region is well represented. **If you have not registered already, please make sure to visit [HarveyRegistry.rice.edu](https://HarveyRegistry.rice.edu).** If you have friends, family, or neighbors in the region who have not registered, please make sure to share the link with them.

# Hurricane Harvey Registry Team

## Chambers County Health Department



**Mary Beth Bess**  
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Public Health Emergency  
Preparedness Coordinator

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## Harris County Public Health



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**Scott Packard**  
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# Hurricane Harvey Registry Team

## Montgomery County Public Health District



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Director

## Victoria Office of Emergency Management



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Emergency Management Coordinator



**Jena West**  
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Director and Rice University  
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**Hien Le**  
Business Systems Analyst



**Rashida Callender**  
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**Jocelyn Hwang**  
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GIS Technical Team Leader



**Nathan Cook**  
Rice University  
Director of Government Relations



# Our Partners

We'd like to thank the following media and community partners who shared their expertise and helped our team develop meaningful relationships throughout the region.

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# HURRICANE HARVEY REGISTRY



Share your Harvey experience at  
**HarveyRegistry.rice.edu**

6100 Main Street MS-460 • Houston, TX 77005  
Email: [HarveyRegistry@rice.edu](mailto:HarveyRegistry@rice.edu)

The Hurricane Harvey Registry is funded by the Environmental Defense Fund, the Cullen Trust for Healthcare, and the National Institutes of Health.

